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Livelihoods, Gender and Climate change in the Eastern Himalayas

Suruchi Bhadwal[1]*, Ghanashyam Sharma[2], Ganesh Gorti[1] , Sudeshna Maya Sen[3]

Abstract

The Hindukush Himalayan region encompasses a large area covering many countries in the North, South and Central parts of Asia. People living in these mountains face huge complexities arising from a number of factors including terrain characteristics, micro-climates , environmental degradation , access to basic services etc. These complexities vary as one moves geographically from one region to the other. The State of Sikkim in the North Eastern part of India also observes similar challenges. Exposure to extreme events is location specific and communities settled in high, mid and low altitudinal regions are differentially affected.

Climate change impacts are disproportionate and influence lives and livelihoods variedly. One crucial determinant of these disproportionate impacts is gender – existing social norms determine roles and responsibilities, entitlements and capabilities, thereby influencing the individual perceptions of shocks and susceptibility which vary across gender groups. The paper seeks to draw insights from the various field studies conducted in these locations to understand the gender vulnerabilities that manifest through a combination of complex and interlinked factors. It seeks to understand the existing social practices typically associated with these gender groups and how changes in the climate are and potentially influence vulnerability. The study makes use of qualitative research methods to understand the gender roles, responsibilities. The study tries to bridge a crucial gap in research – of providing empirical evidence on gender mediated vulnerability in an under-researched climatic hotspot

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– the Hindu Kush Himalayan region. The study reiterates the role of place-based vulnerability in influencing lives and livelihoods and emphasises on the lack of access to human, financial and natural capitals as predominantly driving gendered vulnerabilities.

Key words: Mountains; Complexities; Gender; Livelihoods; Vulnerabilities, Intersectionality

Highlights:

- Livelihood diversification and education can potentially influence vulnerability of communities
- Gender specific differences in vulnerabilities arise due to variations in roles and responsibilities associated to these gender groups
- Gendered vulnerabilities are exacerbated by lack of access to natural, financial and social capital
- Targeted policies that seek to address these underlying issues of access to or availability of capitals must be built in climate hotspots such as the Hindu Kush Himalayan Region

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1. Introduction

The Hindukush Himalayan (HKH) region encompasses nearly 3,500 kilometres of landmass, covering many countries in the, South, Central and Eastern Asia. The region serves numerous transboundary river systems which depend on the glacier and snow-peaks. Sustaining around 1/6th of the world-population, such glacier and snow-pack dependent river basins (Kundzewicz et al., 2007) provide for the lives and livelihoods of many. However, dominated by mountain landscapes, the higher regions of these river basins face challenges arising predominantly from its topography which manifests in biophysical and socio-economic variations that perpetuate issues relating to availability of and access to natural resources and basic services. Moreover, it is predicted that the warming arising from climate change in these regions will be significantly higher, along with an increase in precipitation and associated extremes (Wu, Xu, & Gao, 2017). Multiple influencing factors both biophysical and socioeconomic, introduces challenges to the population living in these regions influencing vulnerabilities.

Since vulnerability is a function of a system's exposure to climatic perturbations, its sensitivity to them and the adaptive capacity of the system to cope with the changes (IPCC, 2007), it is mediated through a host of determinants including the larger political economy within which the system is governed (Füssel, 2010). Factors such as access and control of resources, power dynamics at the household and village level (Coirolo & Rahman, 2014) play an important role in determining the outcome (vulnerability) for a system, or an individual. Thus vulnerability can vary within and across groups (Adger, 1998) and so can it evolve overtime as it arises from non-climatic factors precipitated mostly through "uneven development processes" (Field et al., 2014).

This concept of differential vulnerability, largely influenced by underlying and interlinked issues, is underexplored, especially in regions facing skewed development trends where the impacts magnify further. It is at this intersectionality of factors influencing a system's/individual's vulnerability does gender play a crucial role. Gender refers to the range of "socially constructed roles, behaviour, attributes, aptitudes and relative power" which are a resultant of social traditions, customs and norms, and associated with being female or male in a given society (Esplen, 2009). Though climate change vulnerability research has emphasised on the role of gender and its effects (Denton, 2002); (MacGregor, 2010); (Demetriades &

Esplen, 2008), empirical evidence stands to be "limited, patchy, varied, and highly contextual in nature", making it difficult to conclude with certainty (Goh, 2012). This is more so appropriate in highly dynamic and exposed ecosystems such as mountains which are likely to be amongst the most vulnerable to climatic changes (McDowell, Ford, Lehner, Berrang-Ford, & Sherpa, 2013).

Nestled within this context, this paper sits at this confluence, where complex existing social inequities converge with potential climatic and environmental changes to influence and reshape (differential) vulnerabilities. The paper touches on the complex intersectionalities that are underplay in certain regions which further contribute to differential vulnerabilities. It seeks to understand the causalities in differential resources access, institutional support and power disparities and how these intersect with predisposed roles and responsibilities. The paper emphasises on the role of ethnicity, poverty and political identity in shaping gender vulnerabilities in the Eastern Himalayan context.

2. Methodology

2.1 Conceptual framework

Based on the IPCC definition of vulnerability components of exposure, sensitivity and adaptive capacity have been considered. While exposure refers to the extent to which a system is exposed to climate variations, sensitivity has been defined as the degree to which a system is affected and adaptive capacity has been defined as the ability of the system to respond to these changes (Figure 1). Vulnerability, a constantly evolving terminology in climate research, has numerous definitional strands (O'Brien, Eriksen, Schjolden, & Nygaard, 2004), but more often than not it has been referred to as the degree of susceptibility to harm arising from environmental or climatic changes (Aryal, Cockfield, & Maraseni, 2014). The concept has evolved over time and Birkmann & Wisner, 2006; Birkmann, 2013 conclude that the concept has widened over time from a rather more intrinsic way of looking at vulnerability to a multi-dimensional structure of vulnerability that encompasses many components including physical, social, economic aspects, institutional and social features viz., ethnicity, caste, class, age and gender (Figure 1) . The framework basically accounts for the complex intersection of multiple factors differently influencing vulnerabilities based on various determinants of vulnerability of women and men and overall socio-ecological

resilience of the system.

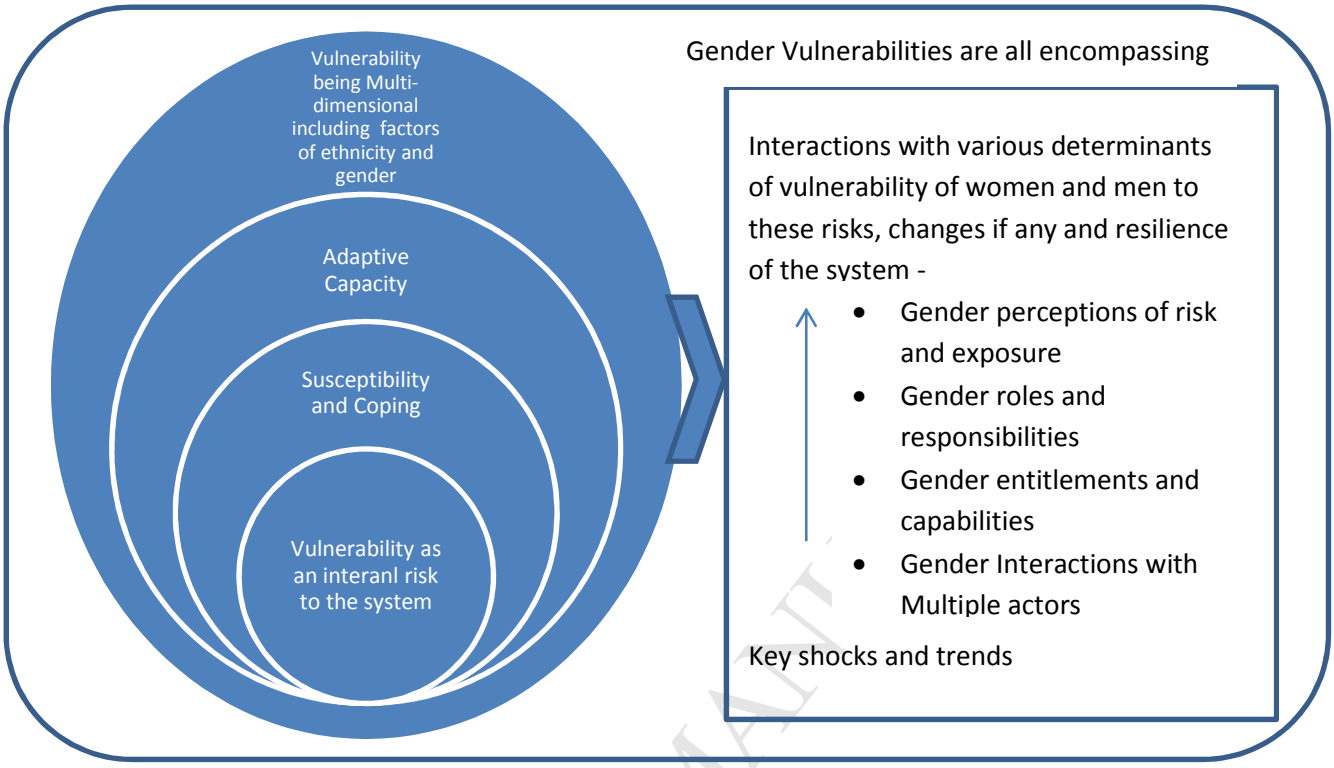

Figure 1: Framework for analysis of Gender Differentiated Vulnerabilities (Modified using Birkmann et. al., 2013)

Using Birkmann's wider framework of understanding on multidimensional vulnerabilities, an understanding on gender differentiated vulnerabilities based on certain determinants has been attempted. This has been done by understanding the vulnerabilities through a multidimensional lens. On one hand through an understanding of the region and its exposure to key shocks and trends, social and economic status and governanceand on the other understanding the gender perceptions on risks and exposure, their respective roles and responsibilities x, gender entitlements and capabilities. This includes considering the various capitals from the Sustainable Livelihoods Framework (SLF) (DFID, 1999) in the analytical process of the content collated from the study sites.

- Natural capital includes the condition of the environment and resource endowment
- Social capital as kin and social networks and safety nets and social organisations etc.,
- Physical capital pertaining to infrastructural support etc.,

- Financial detailing access to savings and credit, insurance;
- Human indicating access to education, health, safety, knowledge and skills, violence free environment etc; political meaning engagement in decision making, empowerment etc.,

Considering all these elements including the perceived risks and gender roles and responsibilities and capabilities the paper aims to span out gender and power dynamics associated within the high and mid elevation regions of Sikkim and tries to capture differentiated vulnerabilities based on geography, caste, class or ethnicity if any.

2.2 Study Site Description

To assist in understanding the linkages between gender and vulnerability, resilience and adaptation in the Eastern Himalayan region, a case study based approach was followed. Since a catchment was selected, study sites were identified in the high elevations areas and the mid elevation areas of the Teesta basin. The Teesta basin draws its waters from glaciers and snow from North Sikkim and many other tributaries flowing from other parts of the state including West Sikkim, which are glacier dependent. The study area comprises the upper Teesta basin and the mid elevation regions lying in the state of Sikkim in India. Several sites have been identifiedacross the elevations and through experiential learning and use of participatory approaches conclusions have been drawn.

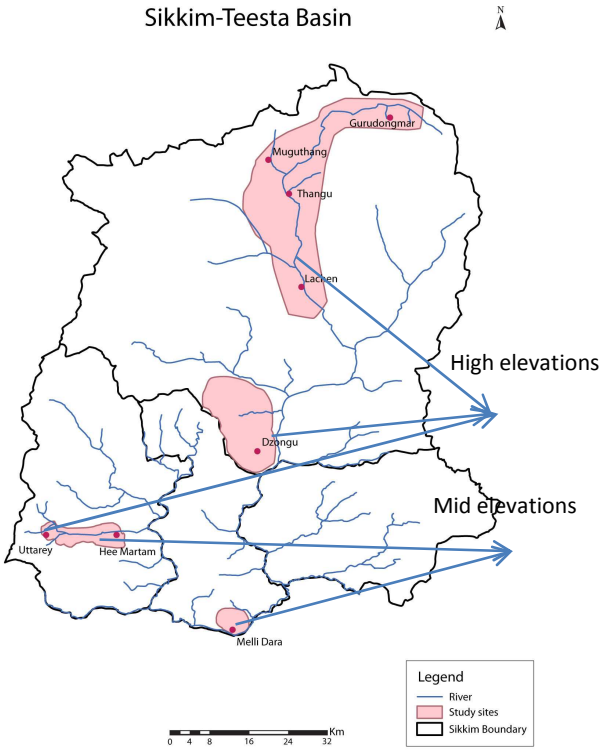

Figure 2: Map indicating the locations of the study sites in the State of Sikkim covering both high and mid elevation locations

The study sites are spread from about 600-1200 m in the mide elevation regions to 2000-3200 m in certain regions and 4000-4500 m in the Trans-

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Himalayan zones of Gurudongmar and Muguthang. Table 1 below provides details of the location of the various study sites including some basic statistics providing description of the area including communities settled.

Table 1: Study sites along the Teesta River basin (also see map).

Study sites		Elevations	Locations	Communities
High elevation sites				
North Sikkim	***Gurudongmar***	***5158***	***N28° 1'34.53" E88°42'39.42"***	***Dokpa/Lachenpa***
	Muguthang	***4826***	***N27°59'34.21" E88°27'51.92"***	***Dokpa***
	Thangu	***4000***	***N27°53'44.37" E88°32'12.13"***	***Dokpa/Lachenpa***
	Lachen	***2700***	***N27°43'47.62" E88°32'58.06"***	***Lachenpa***
West Sikkim	***Uttarey***	***2100***	***N27°16'17.69" E88° 5'36.07"***	***Rai, Manger, Chettri, Limboo, Gurung***
Mid elevation sites				
West Sikkim	***Hee-Gaon***	***1416***	***N27°15'20.88" E88°10'53.55"***	***Limboos, Chettri, Brahmin, Pradhan***
East Sikkim	***Pendam***	***900-1500***	***N27°12'40.37"***	***Brahmin, Chettri, Pradhan,***
South Sikkim	***Melli-Dara (Sadam)***	***600-1000***	***N27° 5'58.32" E88°25'51.00"***	***Limboos, Chettri, Brahmin, Rai, Pradhan***

Source: Elevation and location source from handheld GPS devices

2.3 Data collection and analysis

PRA (Participatory Rural Appraisal) techniques were employed for data collection, and included methods such as key informant interviews (KIIs), focus group discussions (FGD) and field observations. FGDs of n = 8 were carried out in the high-elevation and mid-elevation sites respectively. These were carried out with gender disaggregated groups. This was augmented with Key Person Interviews. These include 12 in the high elevation sites and 4 in mid elevation sites.

The data collected from FGDs, and interviews included information on division of labour between males and females, gender differences in farming, on-farm and off-farm activities,

livestock related knowledge and skills, introduction of technology and it's utilization, decision making processes, and access and control to household, community decision making and economic resources. Tools include development of the gender calendar to assess varying roles and responsibilities that further determine the differing capacities, timeline assessment and individual testimonials to get insights and collect detailed information at both intra and inter-household levels. Specific interactions with ethnic communities and community based line agencies and government and non-government and community based institutions have been conducted. Based on the study framework and research objectives, semi-structured approach was followed and employed for the various interactions.

3. Research Findings

3.1 Key shocks and trends

Geographically, both high and mid elevation regions of Sikkim are sensitive to extreme conditions including heavy precipitation incidences and tough topography that surrounds the region. As one traverses from the high elevation reaches to the mid elevation reaches of the State the key shocks vary. There are risks to glacial lake outburst floods (GLOFs), heavy precipitation events, extreme cold blizzards, landslides, mud slides, rock fall, hailstorms in the high elevations. In case of the the mid-elevations these relate more to heavy precipitation andlandslides causing huge damage to man and infrastructure. Trends of temperatures over a period of 1977 to 2000 indicate that there is not much change in the maximum temperatures. However, minimum temperatures are found to have increased by 2.5 degree Celcius from 1957 to 2009. Temperatures have increased far more in the high and mid elevation regions. On an overall rainfall has reduced. However these trends are studied using the data from one station in Gangtok and Tadong and the conditions may vary as one traverses from one location to the other. Limitied data and information therefore prohibits to get a full understanding on the nature of changes thereby making experiential learning an important source of information to document changes.

Complexities due to the prevailing geography arise as the reach up to the high elevation regions is quite difficult and many of these areas are quite remotely placed. Frequencies of hazards like landslides are perceived to have also increased due to construction activities in these areas. Gurudongmar is quite far and remotely located. There are hardly any habitations in between as one moves from Thangu to Gurudongmar and the trek to Muguthang takes

nearly 10-12 hours from the last connected location by road. While Gurugongmar is connected by road, the only connectivity to Muguthang is through the long trek that traverses very complex terrain through many mountains and valleys and water bodies. Risk to GLOFs exists with repercussions downstream. Since most of the area in Sikkim is protected area and the lakes are located upstream most of the damage due to the GLOF is foreseen to affect the biota largely. Many lakes are near full capacity and therefore strategies to sequentially drain them in a manner that the water is beneficially utilised is needed. Harsh weather conditions also create complexities for travel and communication in the region. Complex terrain presents challenges to health.

Most of the high mountain regions have protected areas. There is a concept of protection of the natural landscapes and sacred groves and “devsthans” that are identified where people do not entertain human interference thereby protecting the natural landscapes. Yak grazing is still a practice by the traditional communities in some of the high elevation regions and is observed still though it is banned as it is a crucial component of living of the ethnic “Dokpa”, “Bhutias” and “Lachenpa” communities.

The percentage of people contributing to agriculture varies considerably with approximately 60 to 80 % engaged in the high elevation and mid- elevation regions respectively. However, agricultural practices and adaptations to the changing climatic conditions are highly variable in time and space due to varying altitudes and agro-climatic situations in the study area as one moves from one elevation to the other. Major crops grown in the high elevation regions include large cardamom in certain places, potato, maize, wheat, peas and leafy vegetables largely some form of spinach. Most of the agriculture is mono-cropping of large cardamom in the mid elevation sites. Large cardamom is an important cash crop, maize and potatoes are grown. While cardamom has a high commercial value it is highly sensitive to weather and therefore presents its own set of risks to the farmer. Cows, pigs and poultry are part of the homestead. Every family on an average owns livestock for self-consumption and manure purposes. Impacts on fodder are seen and its subsequent effect on the animal husbandry has had implications on the livestock keeping and incomes drawn through them. Some families are also involved in trout farming.

With regards to natural resources, all the villages both in Mid and High elevation depend on rainfall and springs as their primary source of water. Snowfall is also a source in high elevation sites, but this has reduced over the years. Ponds are not common but a few

households have access to small ponds and micro-springs on their private lands. Challenges due to water availability have been highlighted. In most cases the crops are rainfed but untimely rainfall and longer dry winters have had an impact on crops. Soil moisture conditions are affected. Drying up of springs in certain locations and reduced discharge levels are reported especially in the mid –elevation regions. Impact of development projects including road construction, hydel electricity, deforestation rates were told to be resulting in reduced recharge of underground aquifers. The conditions are further aggravated due to erraticity of rainfall and reduced rain and snow in certain cases.

Another source of livelihood for some of the villagers is tourism. Trekking, homestays are a source of livelihood for some of the households during tourist season usually from April end to June and from Sept – Nov months. Given the increased dependence on agriculture, the communities in mid and high elevation regions of Teesta are sensitive to climate variability and changes in the climate, including extremes. Incomes from livestock and tourism though provide opportunities for alternative sources of income, are also sensitive. The sensitivities of households also increase in the mid elevations and to some extent some parts of the high elevations based on availability and access to water.

The households are more or less uniform in their adaptive capacities. Adaptive capacities vary based on the extent to which a household is diversified and the educational levels. However, there is not much variation in the wealth and other economic; development conditions surrounding households in the high and mid elevation regions of Sikkim.

3.2 Determinants of Vulnerability in the high and mid elevations of the Teesta in India

3.2.1 Gender perceptions of risk and exposure to climate shocks

Temperatures have been reported to increase across all elevations. While hotness has increased, coldness has declined. In high elevation regions, in some cases rainfall has declined over some months and increased during the peak season causing rain storms, thunderstorms, landslides in the mountain terrain. Wind storms have also increased having impacts on the houses as the structures are not wind resistant and therefore damage to houses have been reported of recent. This increases the workload of rebuilding and reinstating houses that get damaged. Men are mostly involved in these activities. While the peak season experiences more rain, it has become dry in the other months compounded by issues of water during these months. Also snow storms have been reported to have become very variable. As

a result grazing of yaks under such weather conditions becomes more challenging. Normally the men remain behind under harsh weather conditions with the yaks for grazing purposes. Most women move down to lower elevations during the winters. While men are far more exposed to the climatic shocks in the high elevation locations, there have been incidences in Lachen where women have been directly affected due to floods and flash floods in the location.

Table 2: Periods during which climatic hazards and events occur (based on FGDs at high elevation (3000-4500 m) study sites along the Teesta River basin). ***(Data collected 2016)***

Events	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Hotness	+++	++	++						++	++	+++	+++
Coldness	–	–	–						–	–	–	–
Rainfall												
Pattern	–	–	–	–	–	+	++	++	++	–	–	–
Rainstorms					+	+	++	++				
Wind												
Wind storms			++	+++	+++					+++	+++	
Hail storms			++	++	++					+		
Cold winds					+++	+++	+++	++	++	++		
Other hazards												
Drought/Dry period	+	++	+++	+++	+++	++				+	+	+
Landslides						+	+++	+++	+++			
Water Scarcity	+	+++	+++	+++	+++						+	++
Forest Fire			++	+++	+++							
Thunderstorms			+	+++	+++	+++	+++	++	++			

+Low intensity, ++ medium intensity, +++ high intensity (extreme)

Mid – hill locations report a far greater increase in temperatures. Similar increases in rainfall in peak season, hail storms pre and post rainy seasons and rainstorms and thunderstorms. Landslides are also common in this region. Hot winds in summer have been reported in addition. Issues of water scarcity and dryness prevail in non-monsoon months. Women reported hardships related to collection of water from distant sources.

Table 3: Climatic hazards and events based on FGDs at mid elevation (800-1500 m) study sites along the Teesta River basin ***(Data collected 2016)***

Events	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												

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Hotness		+	+	+++	+++	+++	+++	++	++	+	+	
Coldness	–											–
Rainfall												
Pattern	–	–	–	–	–	++	+++	+++	++	–	–	–
Hail storms			++	+++	+++					++		
Rainstorms					+	+		++	++	+++		
Wind												
Wind storms				++	++					++	+	
Hot winds					+++	+++	+++					
Other hazards												
Drought/Dry	+	++	+++	+++	+++	++				+	+	+
Landslides						+	+++	+++	+++			
Water Scarcity	+	+++	+++	+++	+++						+	++
Forest Fire			++	+++	+++							
Thunderstorms			+++	+++	+++	+++	+++	+				

+Low intensity, ++ medium intensity, +++ high intensity (extreme)

3.2.2 Distributed gender roles and responsibilities

Field interactions indicate that the roles and responsibilities, knowledge and decision making of men and women differ in overall management of agriculture and domestic sector as well as other intra and inter-household activities (Figure 3).

Roles played by women

Reproductive labour
1. Cooking, looking after children etc.
2. Feeding livestock
3. Grazing goats/sheep
4. Fuelwood collection
5. Seed saving, storage, preservation, allocation to different field types
6. Household expenditure

Productive labour
7. Minor tillage in the farms, weeding,
8. Sale of vegetables, NTFPs or other agricultural produce to the market
9. Shared labour in farms
10. Mostly members in women SHGs
11. Tea leaf plucking

Women and Men

Productive labour
1. Milking of animals
2. Weeding, sowing, manure transport to farms from the sheds
3. Fodder collection
4. Disease management of livestock
5. Crop production
6. Spending money
7. Borrowing money
8. Livestock business
9. Education, health, miscellaneous expenditure
10. Sale of livestock/livestock products
11. Participation in community interactions, meeting, *Gram Sabhas*
12. Members in local self-government (panchayats)

Roles played by Men

Productive labour
1. Ploughing, major, tillage
2. Plantation, species selection, tree fodder collection
3. Livestock breeding
4. Terrace management, wall construction, repair of houses, *kholma, khor, guali*
5. Cardamom/ginger sale in the markets
6. Spring management for domestic use and in agriculture
7. Local community based institutions, traditional institutions such as *Dzumsa* of Lachen and Lachung

Figure 3: Gender differentiated roles and decision making for various activities in the household and in the farm.

In our study sites, both men and women engage in on-farm and off-farm activities. The participation of women in many of the agriculture and livestock management activities is predominant irrespective of economic status and agro-climatic zone. It is also observed that the contribution of women belonging to higher castes in agriculture and livestock management is lower as compared to women from ethnic groups.

Besides, women of all ethnic groups and economic status in both mid and high elevations are rigorously involved in household chores - collection of drinking water, fodder and fuelwood collection, livestock keeping.

In the high elevation sites of Muguthang and Gurudongmar Plateau area, Dokpa women are mostly involved in household chores and milking yaks and the men are responsible for pasture management, feeding yaks, and grazing, while in Lachenpa communities in Lachen and Thangu, men are mostly involved in the farms, construction, tourism services, running tours and travels, fuelwood collection. In certain cases sharing of workload by men has been observed, especially bringing changes in the ethnic communities and their culture. It is felt that these changes are largely influenced by tourism, migrants from other areas. There are positive examples of women also entering entrepreneurial business and eco-tourism. More women owners are getting involved in homestay management in high and mid elevation regions in Sikkim. Some women have also actively started getting involved in farm produce marketing. In high mountain Lachen, Thangu and Muguthang women roles, participation and knowledge is higher in on-farm activities and domestic care. In Lachen women are into homestay management during peak seasons. Literacy, higher social awareness, ethnicity, market effects are influencing factors.

In mid elevations it has been observed that access to resources presents challenges to the women. This is largely related to the collection of water from the sources in case the nearby sources have dried up. Weather induced conditions affect crops and that brings increased amount of work primarily for women.

3.2.3 Gender entitlements and capabilities

Throughout the Teesta River basin, there are gender specific differences in the nature of work, customary rituals, natural resource use, consumption patterns, lifestyles, access to and

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control of resources. Following the attributes of the sustainable livelihoods framework by DFID, an attempt was made to understand the gender entitlements and capabilities in the Upper Teesta basin based on gender access to and control over livelihood assets. However, it has been observed that gender roles and relations may vary by ethnic groups based on customary rules and rituals that may prevail.

Table 5: Gender entitlements and capabilities in the Upper Teesta basin in India

Human capital	1. Women have equal workload as their male partners in livelihood activities 2. Literacy rates are higher for men. However the literacy rates of women when compared to the national average are far higher. 3. Work related to road laying especially work under Mahatma Gandhi National Rural Employment Guaratntee Act - women usually involved 4. Women largely engaged in more unskilled labour than men in the mid hill regions of Sikkim 5. Since the frequencies of hazards like landslides are perceived to have increased both men and women in high elevation and mid elevation regions are affected. 6. In high elevation sites, lack of access to nearby health facilities, proper road connectivities restricts immediate response during health emergencies. Mobility of women in these cases is far more restricted given the complex terrain 7. Contribution of women belonging to higher castes in agriculture and livestock management is lower as compared to women from ethnic groups
Natural capital	1. Land tenure is under the control and name of the men. Only a few women have the land title and power to dispose-off the land 2. The main cash crop in Sikkim is large cardamom. Traditional crops dominated the agricultural land until 1975 but cultivation of cash crops currently dominates agricultural land. This leads to narrowing of livelihood resource base as cash crops replace traditional crops and is related to food security and erosion and/or loss of traditional agricultural knowledge held by women. Presently only 42 % of people are cultivating some traditional varieties of crops (Saxena et al. 2005; Rahut et al. 2010). 3. Land has been diverted for other development uses including hydropower and pharmaceutical needs resulting in the shrinking of the cultivated farms and forest land as well as repercussions on the natural resource base including impacts on springs. 4. Forest resources are used for fuelwood, fodder and NTFP. Women and men are both involved in household chores but women have to travel more for fuelwood and fodder. The households' dependence is now on food material procured from the market, often low-quality food coming from the plain areas.

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	5. Water sources beside rivers are mainly spring sources. These sources are scattered around mid-elevation. Women most concerned about domestic water needs. Male counterparts looked at water availability with focus on irrigation needs. Drying up of springs has increased the drudgery for women with increased time requirements for water collection.
Financial capital	1. Women are increasingly having a decisive role in cash flow in high elevation sites. Earlier was controlled by only men. 2. In the mid elevation sites women have the custodians of cash at home. Everyday smaller expenses are handled by women but larger transactions are under men's control 3. Since owner of land assets etc. is largely with men, access to credit and collateral favours men. Although several schemes for women have been launched, most women are not aware of them. 4. Self Help Groups are an institution which are helping women across elevation gain financial power, although the amounts are smaller.
Physical capital	1. Roads improve access of regions and have transformed certain areas. However in the high elevation sites, there are still many regions that are remote and lack direct accessibility to road. Women get differentially affected in these cases. In most cases such remote habitations consist of the ethnic communities. 2. Transportation and road conditions are a major problem in various places of high altitude areas of Teesta basin raising issues of access to elementary services like access to health and markets 3. Both men and women are likely to get employment in the development activities going on in the region.
Social capital	1. In high elevation sites largely dominated by the inherent population/ the ethnic communities (indigenous), traditional institutional structure called the Dzumsa in high elevation mostly in Lachen and Muguthang favours men. Almost 98% of the households have male as family heads. Here decision making power rests only with males for all resource use. 2. The customary practice allows men attending all meetings and women can only advise their male partners to have voice their concerns in the meetings. Though the practice is changing slightly a major constraint with any women speaking for her concerns gets limited with the meetings having majority men. 3. In mid and high elevation study sites at Uttarey and mid elevation sites women have 33% reservation for their position in Panchayati Raj, while 80% households have male as male heads of the family. 4. The government development schemes and other development agencies schemes have favoured constitution of local women self-help groups and are given opportunities for saving, credit and utilization of revolving funds.

Though there are not many distinctions that one can summarise across both high and mid

elevations, the biggest difference arises with women lacking human, physical capital and ownership of resources compared to men. There is financial independence that is observed to some extent for smaller activities. In high elevations there is far greater control of monetary resources by women.

Field evidence indicates that despite the women's high participation in intra household economic activities, farm agriculture including livestock management, they have limited control and decision making power in economic decisions for instance decisions related to crop choices, livestock trade, investment and use of household income at both intra and inter household levels. Their access to property resources—farmland, houses, livestock and others is mainly through men. Hence there is a disproportionate share of physical properties that is observed – it has been observed that married daughters, widows and unmarried women are denied share in fixed assets.

3.2.4 Interactions of multiple actors and influences

In Sikkim, ethnicity plays an important role in the political history of Sikkim (Chettri, 2013). According to field interviews and focus group discussion parallel stories of how these identities shape resource access were revealed. The leadership in Sikkim has been dominated by the Nepalis for many years now. Therefore there is a feeling of being marginalized by the state. Such perceptions on both sides lead to allegations of unequal treatment, biased political systems and conflicts regarding reservations and political representation. These eventually lead to issues of inequities at the local level with interviews suggesting that specific households are excluded in the benefit sharing as their categorization, political and ethnic associations differ from the local panchayat in power. Such structures eventually affect gender roles as well (Walby et al. 2012).

Institutionally women of ethnic communities are at a disadvantage as the Dzumsa, the main decision making body of the region does not have women participation in the meetings. As a result of the traditional and customary construct within ethnic communities, this situation emphasises the dominant economic positions of men and how they retain them. If we generalize this statement for the entire Teesta River basin, even with the increasing number of women in agriculture and as labour force, women are still constrained with limited access to productive resources and extension information.

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Cultural impacts due to migrants was expressed as a fear by the ethnic communities. The construction of dams and roads has in certain cases brought people from other locations and cultures to settle in these locations. Also the spread of new diseases was highlighted.

4. Discussion

Mountain regions are highly sensitive to extreme events. These greater sensitivities combined with arduous terrain presents further challenges for both men and women. Moreover, given the reliance on climate-sensitive livelihoods, like farming and livestock rearing, greater exposure to vulnerabilities is experienced. This is especially relevant in the Teesta basin where a considerable proportion of the population are involved in agricultural and agro-pastoral activities. Our study reiterates the place based sensitivities to climatic and environmental aberrations that exist and which are reinforced due to underlying socio-economic conditions. These sensitivities vary by caste, ethnicity and location.

With the background indicated above on gender roles and relations cutting across the study sites, it is observed that women stand to be highly vulnerable in most cases to the changes in the climate and its extremes. While incomes are affected and influence vulnerabilities, availability and access to water sources in the mid elevations constitutes as a primary reason for enhancing vulnerabilities. Those near the water sources and traditionally settled have better access to the resource compared to settlements that have moved into those areas from other locations. Also, marginal landholders (< 0.5 ha) and those with no livestock are the most vulnerable given their income sources are not diversified. The marginalised groups including women have been found to be particularly vulnerable to climate change as a result of their limited access to assets, influence, control over resources, and networking to access services and institutional support (Gautam et al. 2007; Skinner 2011).

High elevation regions, both men and women are exposed to harsh weather conditions. While women migrate seasonally to low elevation regions and manage other work including homestays, some men folk remain behind to manage the cattle, especially yaks. Tourism in the high elevation regions is affected during the winters as very cold temperatures prevail. This includes impacts on homestays and hiring of yaks, porters etc., Communities however are self-sustained and are able to support themselves with the food they grow and with support from livestock. Communities are organised in a way to plan for the cold weather. Food like yak cheese, milk and other related products are processed during the warm months

for intake during the winter and in case of excess production, sale in the markets.

However, gender sensitivities arise specifically from the lack of, either access or availability, to natural and social capital, to a large extent, while access to financial capital, add-on to these existing sensitivities, rendering women more vulnerable to implications from climatic shifts and anomalies. Women are, to a large extent, not involved in financial dealings and decision making surrounding it. In some places women do handle the day to day cash flows but larger financial decisions are in the control of men. The poor social capital of women interplays with lesser exposure to and understanding of early warning systems, lack of information accessibility, as a result of age old norms and practices being followed eventually reduces the ability of women to take protection measures during critical moments (such as before and after flood situations or other disasters) thereby increasing their vulnerability to extreme weather events.

Building on this, we have also found that women, in certain cases are found to be more vulnerable. Interactions with the Dokpa women of Muguthang, Lachenpa women of Lachen and Nepali women belonging to different ethnicity in the mid elevations reveals the importance of the knowledge that they have related to the preparation of yak cheese and ghee and the need for transfer of it to the next generations. Men on the other hand retain knowledge about grazing lands and weather conditions, trekking routes etc., while women are known to run homestays and look after the house and prepare milk based products for the markets. It is observed that the knowledge on the biodiversity varies by both men and women and therefore needs to be preserved (Howard 2003).

Engaging women in income-generating activities and providing ownership would help empower many women across all elevations. There is a need to empower women in these areas through targeted skill development programmes for better wages and off-farm employment and engagement of women.

These gender differentiated vulnerabilities influence lives and livelihoods in an intertwined and mostly unseen ways. Most of these are a resultant of existing social constructs and dependence on environmentally sensitive livelihoods. Thus, understanding how inequities in decision making manifest (Arora-Jonsson, 2011)and therefore propagate vulnerabilities, is a crucial step towards addressing gender in climate policies. However it also important for policies to explicitly acknowledge the need to account for gender dimensions along with

other social differentiation factors to enable a conducive action oriented environment to address entrenched gendered vulnerabilities. This study, thus, builds on the existing gap in literature and the need for case based studies to understand the linkages between climate change and gender (Arora-Jonsson, 2011), with the goal of mainstreaming gender into climate action.

5. Disclaimer

The views expressed in this work are those of the creators and do not necessarily represent those of the UK Government's Department for International Development, the International Development Research Centre, Canada or its Board of Governors.

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